Department of biology

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((Theoretical Histology))

Stage (-3-)

LEC- (8)

Supporting Connective Tissue

&

Hematopoietic Connective tissue

By

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Supporting connective tissue:

1- It is a stiff connective tissue where the matrix is solidified.

2- It provides the general framework of the body.

3- Supporting C.T is of the following two types: **Bone** & **Cartilage.**

A- Bone:

is a type of connective tissue that has a supportive and protective function and also serves as a reservoir for **calcium** and **phosphate.**

Functions of bones:

1- Provides solid support for the body

2- Protects vital organs such as brain, heart, lung and bone marrow.

3- Serves as a reservoir of calcium, phosphate, and other ions

4- Has a role in body movements.

5- Bone marrow is where blood cells are formed.

♥ Bone confers mechanical and metabolic functions to the human body.

Bone composed from:

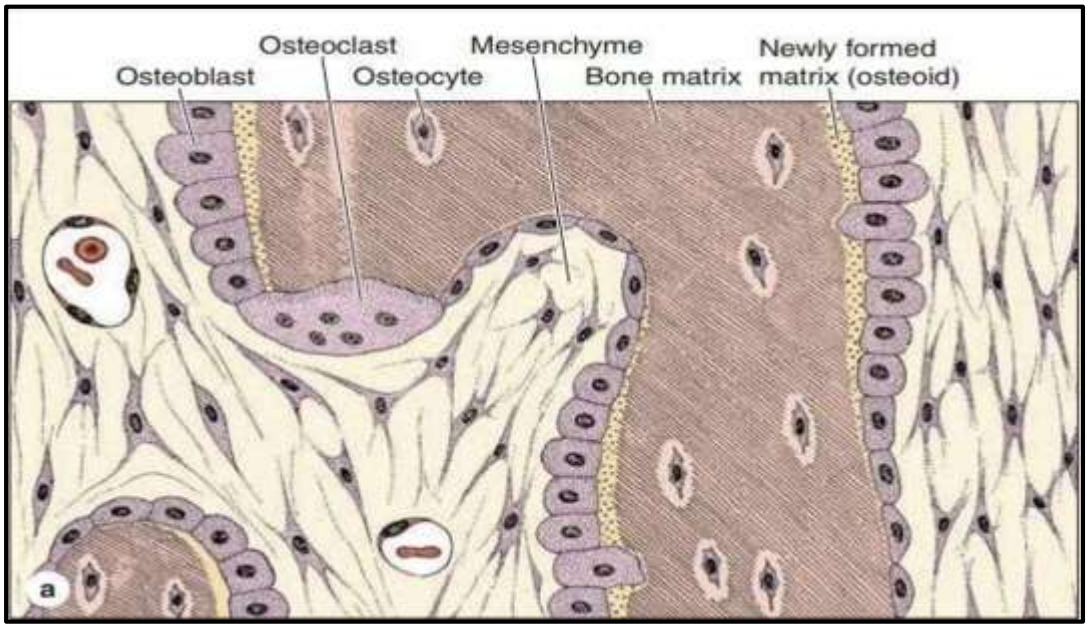
A- Bone matrix

B- Three type of cells:

1- Osteocytes (bone cells): which are found in cavities (lacunae) between bone matrix layers (lamellae).

2- Osteoblasts (growing cells): which synthesize and secrete the organic components of the matrix

3- Osteoclasts: which are giant, multinucleated cells involved in removing calcified bone matrix and remodeling bone tissue.



Note: all bones lined on their **internal and external**

surfaces by **endosteum** and **periosteum**.

1. ***Lamellae***: rings of hard, calcified matrix that are arranged concentrically around central canal.

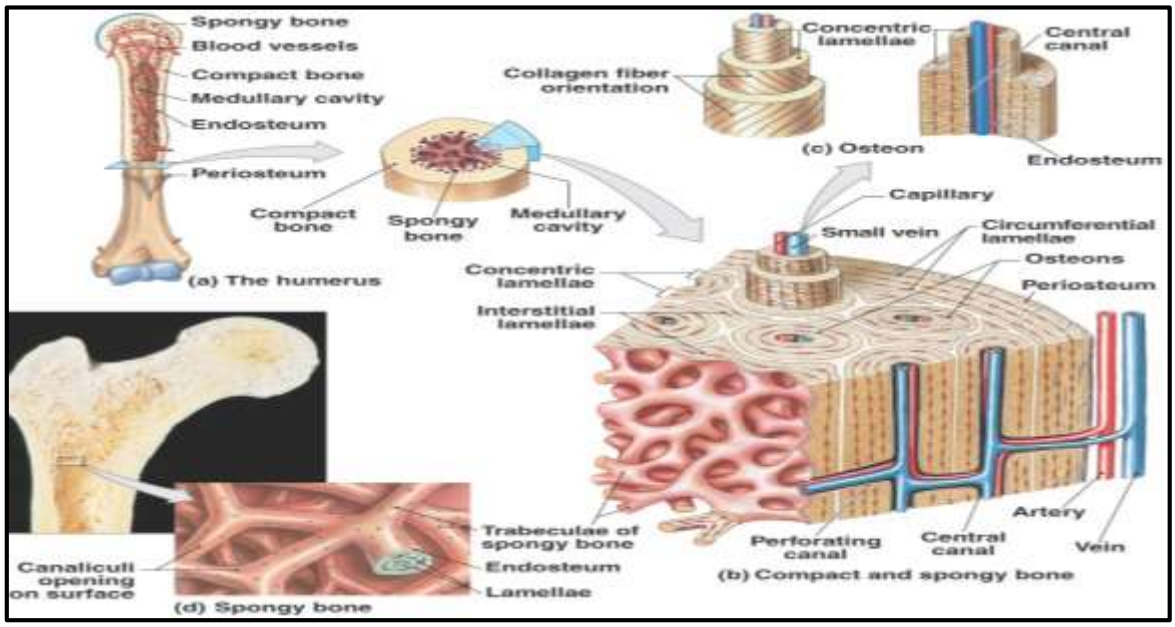
2. ***Lacunae***: small spaces between lamellae that contain osteocytes.

3. ***Canaliculi:*** outward extensions of osteocytes from lacunae connect with each other and finally with central canal. Form a branching network throughout bone to provide numerous routes for nutrients and oxygen delivery.

4. ***Central canal (Harvesian canal)***: canal run lengthwise through bone; contain blood vessels and nerves.

5. ***Osteons (Harvesian system):*** each central canal with its surrounding lamellae, lacunae, osteocytes, and canaliculi makeup an osteon.

6. **Volkmann`s Canals**: They are transverse canals connecting blood vessels in the Haversian canals to each other and to those in the periosteum and in marrow cavities.



Types of bone:

There are five types of bones in the human body:

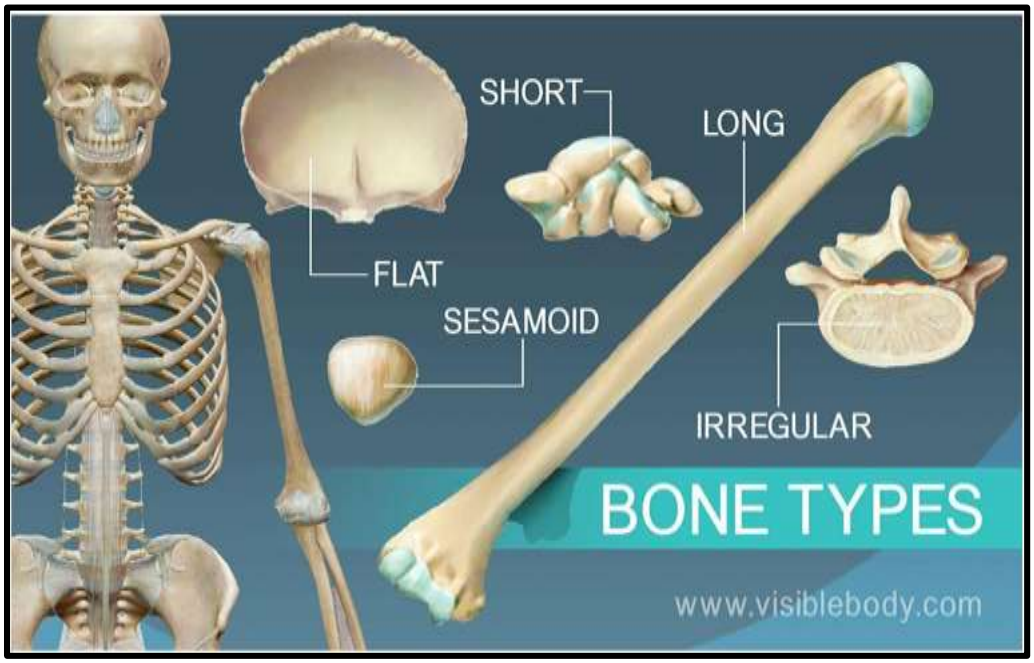
1. Long bones: These are mostly compacted bone with little marrow and include most of the bones in the limbs. These bones tend to support weight and help movement.

2. Short bones: Only a thin layer of compact bone, these include bones of the wrist and ankle.

3. Flat bones: Usually bones that are thin and curved. They consist of two outer layers of compact bone and an inner layer of spongy bone. Flat bones include most of the bones of the skull and the sternum or breastbone.

4. Sesamoid bones: These are embedded in tendons, such as the patella or kneecap. They protect tendons from wear and stress.

5. Irregular bones: As their name implies, these are bones that do not fit into the first four categories and are an unusual shape. They include the bones of the spine and pelvis. They are often protecting organs or tissues.



There are two types of mature bone:

A- Compact bone: which is found in the long bones. This makes up **80%** of all bone.

GENERAL STRUCTURE OF BONES:

BONE MEMBRANES

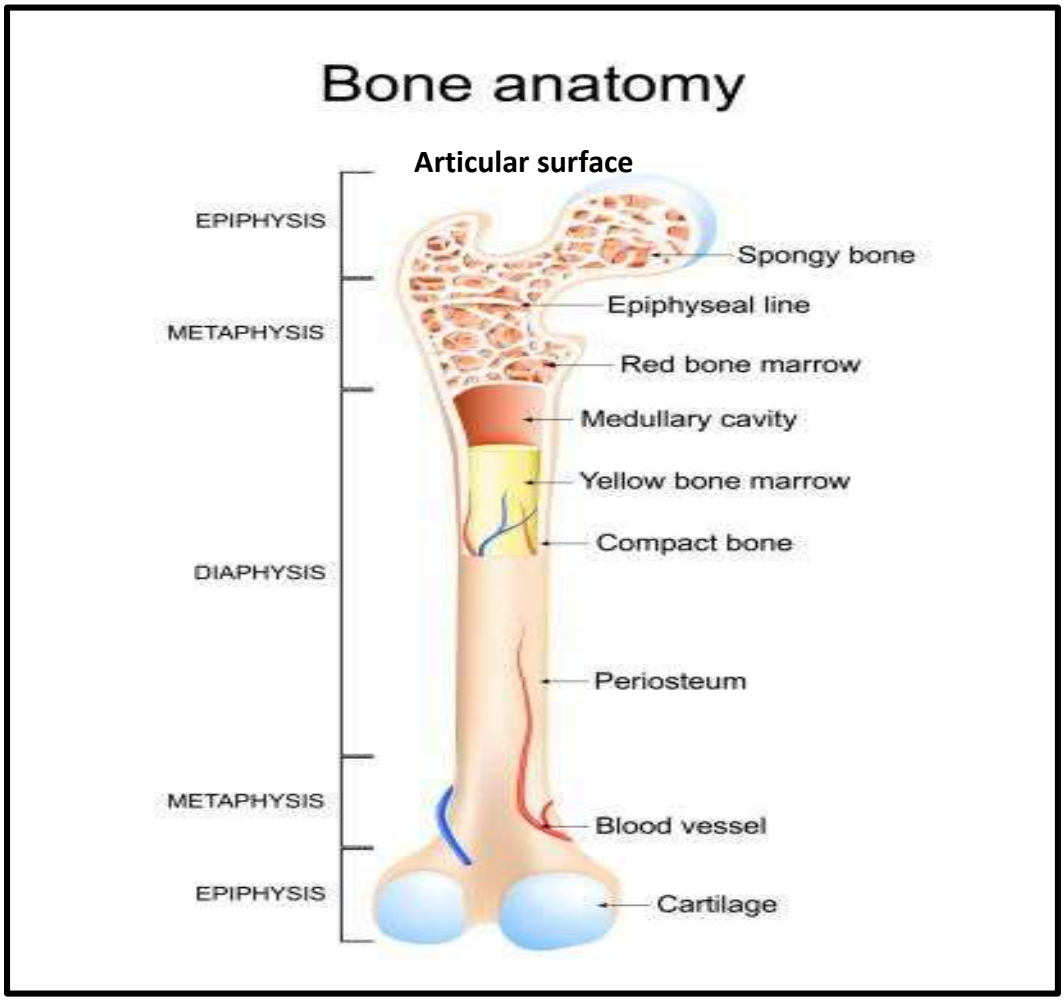
A- The external and internal surfaces of bones are covered by membranes called periosteum and endosteum respectively

B- They have osteogenic potential and are essential for growth and repair

1- Periosteum: covering the long bone, and formed of two layers:-

- Outer fibrous layer of collagen fibers.
- Inner cellular layer of osteogenic cells and osteoblasts.

2- Endosteum: a cellular layer lining the bone cavities and formed of osteogenic cells and osteoblasts.



B- Spongy bone: which is found at the ends of long bones. This makes up **20%** of all bone.

Is lamellar, but it doesn't form the orderly osteons of compact bone. Instead it forms **trabeculae** the spaces between the trabeculae are continuous with the main marrow cavity in the **diaphysis and contain marrow**.

B- Cartilage:

- Cartilage is an avascular connective tissue specialized in providing **support**, **rigidity** and some **flexibilty**.
- It is composed of **ground substance (matrix)**, **cells chondrocytes** and **fibers.**

- Its ground substance is firm and compact consisting of **chondro - muco- protein.**

Types of cartilage: Based on the composition of the matrix there are three types of cartilage

A- Hyaline cartilage (**most common**)

B- Elastic cartilage

C- Fibrous cartilage

A- Hyaline cartilage:

Hyaline cartilage is the most abundant of the three types of cartilage.

temporary skeleton in the fetus until it is replaced by bone (**nose**, **larynx**, **trachea, bronchi**)

The main structure is:

1- Matrix: The matrix is composed of an amorphous ground substance containing proteoglycan aggregates and chondroitin, in which type II collagen is embedded . (bound to core proteins).

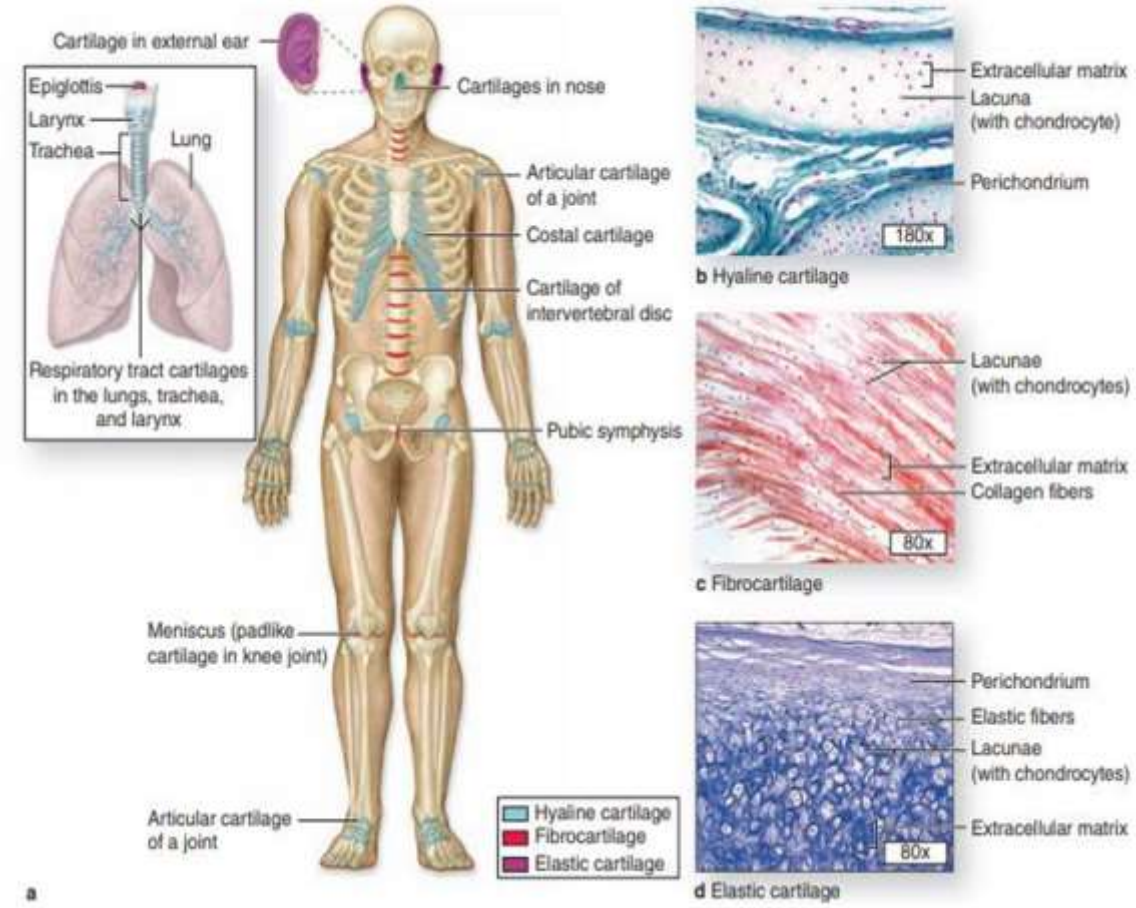
2- Perichondrium: is a layer of dense irregular connective tissue that surrounds hyaline cartilage except at articular surfaces.

B- Elastic cartilage:

Elastic cartilage which is **yellowish in color**, the cartilage cells (chondrocytes) are located in a threadlike network of elastic fibers within the matrix of the cartilage. A perichondrium is present. It is found in: **Auditory Tubes**, **External Ear**, **Epiglottis** .

C- Fibrous cartilage:

Fibrocartilage is a tough form of cartilage that consists of chondrocytes scattered among clearly visible dense bundles of collagen fibers within the matrix. **Fibrocartilage lacks a perichondrium**. It is found in: **Intervertebral discs** (i.e. **the discs between the vertebrae of the spine**). **Pubic symphysis.**



Hematopoietic Connective tissue:

Blood is classically considered to be one of the connective tissues, since it has all of the three components which characterize these: fibers, an amorphous matrix, and cells.

Blood is a circulating tissue consisting of three types of cells:

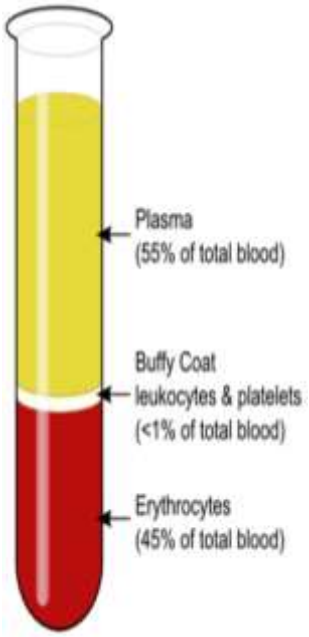
1. **Red Blood Cells → Erythrocytes**
2. **White Blood Cells → Leukocytes**
3. **Platelets → Thrombocytes**

- **Red blood cells make up 99% of the blood cells.**
- **White blood cells and platelets make up the other 1%**

Blood is a viscous fluid formed of cellular element suspended in plasma

Composition of Blood

- **Plasma: is made of 90% water and 10% proteins, lipids, carbohydrates, amino acids, antibodies, hormones, electrolytes, waste, salts, and ions**
- **Blood cells: make up the remaining 45% of the blood.**



Functions of blood:

Blood is responsible for

1. **Transport of dissolved gases, brining oxygen from lungs to the tissues and carrying carbon dioxide from the tissues to the lungs.**
2. **Distribution of nutrients absorbed the digestive tract or released from storage in adiposed tissues or the liver.**

3- Prevention of fluid losses through damaged vessels or at other injury sites.

4- Defense against toxins and pathogens.

5- Delivery of enzymes and hormones to specific target tissues.

6- Stabilization of body temperature by absorbing and redistributing heat.

Erythrocytes (RBC):

Concentration in blood : is approximately **3.9-5.5 million/µL in Females** and **4.1-6.0 million/µL in males.**

• **Function:** transport of oxygen and carbon dioxide bound to hemoglobin.

• **Life span: 120 days**, when they are removed from circulation, mainly by macrophages of the spleen, liver, and bone marrow.

Leukocytes (WBCs):

Classified into two main groups based on nuclear shape and cytoplasmic granules:

1- Granulocytes nuclei have two or more distinct lobes and include (neutrophils, eosinophils, basophils) named according to their staining properties.

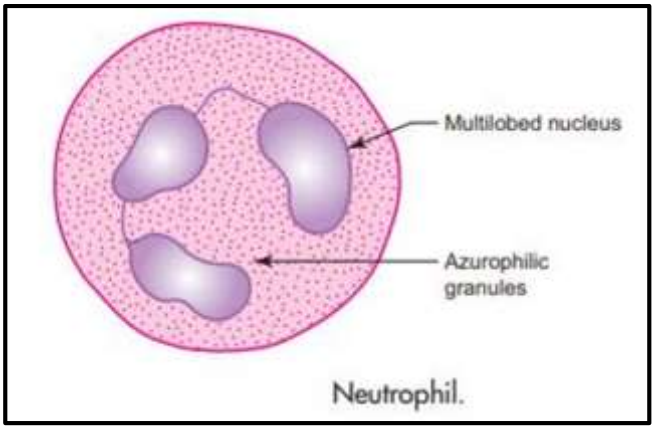
2- Agranulocytes lack specific granules, but do contain some azurophilic granules (lymphocytes and monocytes).

A- Neutrophils:

form the first line of cellular defense against bacteria by engulfing and destroying them.

- They increase in number during acute inflammation.

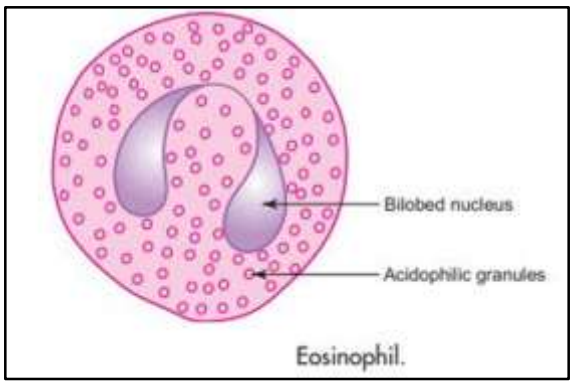
- Dead neutrophils are called pus cells.



B- Eosinophils:

involved in selective phagocytosis of antigen antibody complex.

-They increase in number in allergic condition and in parasitic infection.

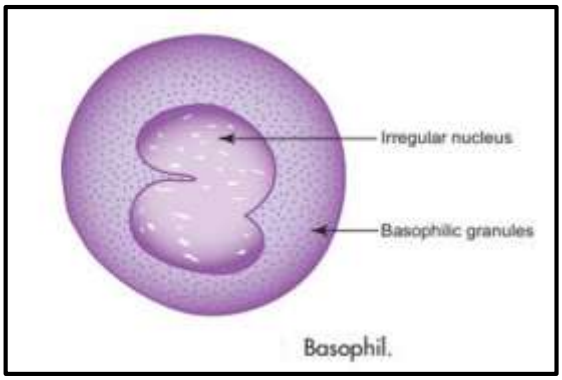


C-Basophils:

functionally similar to mast cells.

- They contain histamine and heparin granules.

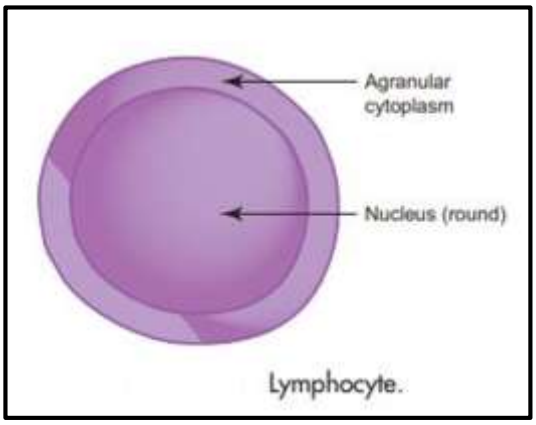
- In response to antigen, histamine is liberated inducing an inflammatory response.



D- Lymphocytes:

smallest cells of the connective tissue with dark spherical nuclei and a thin rim of basophilic cytoplasm.

- They increase in number during chronic inflammatory conditions



E- Monocytes:

are highly motile and phagocytic cells; i.e. they are the precursor of tissue phagocytes that migrate into tissues .

their nucleus is kidney or C-shaped.